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The Effect of Teamwork on Innovation Performance: Does Organizational Culture Have Some Influence?

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Abstract

This study has two main goals: (1) to investigate the relationship between teamwork and incremental and radical innovation performance, and (2) to analyze the moderator effect of organizational culture on these relationships. Data were collected from 138 manufacturing companies in 11 countries. The research model and hypotheses devised are tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results show a positive, and nearly equal, effect of teamwork on radical innovation and incremental innovation performance. In addition, there was no change in the intensity of the relationships by different types of organizational culture. The findings show that in promoting teamwork-related practices, such as involving employees with different know-how and skills, developing self-managed teams with decision-making capacity and using employee reward systems for problem-solving may contribute to fostering innovation.

Keywords*: teamwork, innovation, organizational culture.*

1. Introduction

Over the last decades, several studies have been published investigating the relationship between quality management (QM) and innovation (e.g. Sciarelli et al. 2020; Eshardi et al. 2019; Kim et al., 2012; Zeng et al., 2017). However, conflicting results have been reported. Most of the studies consider different sets of practices and principles, without making explicit at what level they are addressing QM. Differences in conceptualization, operationalization and/or measurement of the key constructs (Gambi et al., 2015) and unclear levels of analysis (Sousa and Voss, 2002), may have contributed to these conflicting results.

While some studies such as Prajogo and Sohal (2003) and Martinez-Lorente (2008), show positive relationships between QM and innovation, others show no significant effects (e.g. Singh and Smith, 2004; Pinho, 2008; Aminbeidokhti et al., 2016). Sciarelli et al. (2020) argue that some studies that show no positive effect of QM on innovation may be related to the way of studying QM as a single factor without investigating the different relationships between QM dimensions and innovation

Therefore, this study does two things. First, it takes the QM-innovation discussion to the level of one single practice, teamwork, common in the majority of QM frameworks (e.g., Zeng et al., 2015; Qasrawi et al., 2017) and, investigates its effect on innovation performance operationalizing both constructs using established scales to reduce problems related to operationalization and measurement. West et al. (2004), for example, concludes that teamwork promotes organizational performance and innovation to the extent that members are engaged in a supportive organizational context. Second, teams do not work in a vacuum. Their effectiveness may be hindered or enhanced by the context in which they function. Therefore, considering that organizational culture is an important contextual variable to innovation success (Martin and Terblanche, 2003; Büschgens et al., 2013) and helps to align employee behavior with organizational objectives of innovation (Jassawalla and Sashittal, 2002), this study investigates the moderating role of organizational culture in the relationships between teamwork and innovation performance.

2. Theoretical Background

2.1 Quality Management and Innovation

Their ability to innovate has been seen as an important factor to support companies' competitiveness. Several authors, e.g. Escrig-Tena et al. (2018) and Tian et al. (2018), point out the importance of innovation in creating sustainable economic development and competitive advantage. In this context, companies have adopted programs such as Quality Management (QM) to contribute to fostering innovation and performance.

Kafetzopoulos et al. (2015) show that QM directly contributes to product and process innovation. The authors state that QM is an opportunity for a company to improve its innovation and consequently its competitiveness. Schniederjans and Schniederjans (2015: 1) argue that the "*… importance of innovation and quality management has motivated researchers to identify various driving forces of innovation and to seek new ways of creating it through quality management practices*".

Indeed, several studies (e.g. Bossink, 2002; Prajogo and Sohal, 2004, 2006; Hoang et al. 2006; Perdomo-Ortiz et al. 2006; Santos-Vijande and Álvarez-Gonzalez, 2007; López-Mielgo et al. 2009; Kim et al. 2012; Zeng et al. 2017; Escrig-Tena, 2018) investigate the relationship between QM and innovation. Prajogo and Sohal (2004), for instance, state that "organic elements" of QM are associated with innovation performance, studies of Lopez-Mielgo et al. (2009) confirm the positive link between innovation capabilities and innovation. However, other authors such as Singh and Smith (2004), and Pinho (2008) find no evidence to confirm the effect of QM on innovation. Castillo-Rojas et al. (2012) even conclude that QM practices can hinder innovation.

Escrig-Tena et al. (2018) state that many researchers try to solve the contradictory results on the relationship between QM and innovation performance using a multidimensional view of QM, but the results are still conflicting. Schniederjans and Schniederjans (2015) state that given the conflicting results it is necessary to adequately define QM. Indeed, QM is a broadly approach, and many definitions have been proposed in the literature. Sousa and Voss (2002) argue that QM has solid definitional foundations, however, they propose that researchers should make explicit at what level they are addressing QM in order to avoid conflicting results due to unclear levels of analysis.

Among the QM practices, teamwork is commonly found in the majority of QM frameworks (e.g., Zeng et al., 2015; Qasrawi et al., 2017). West et al. (2004), for example, conclude that teamwork promotes organizational performance and innovation to the extent that members are engaged in a supportive organizational context. Besides, Ali et al. (2010) argue that teamwork is one of the most important practices that are critical to ensuring successful QM implementation. Therefore, this study focuses on a single QM practices: teamwork, and evaluates its impact on incremental and radical innovation performance.

2.2 *TEAMWORK AND INNOVATION*

Teamwork can be defined as a social system of three or more people who collaborate on a common task (Hoegl and Gemuenden, 2001). According to Abrunhosa et al. (2008), QM is built on the principle that companies should encourage their employees to continuously search for new ideas and improvements. In this context, the authors state that it is widely recognized that teams play an important role in innovation, and they confirm that in their research, although the effect they find is hardly significant. Other studies recognizing the importance of teamwork in fostering innovation include Ali et al., 2010 and Folkestad and Gonzales, 2010. In addition, Lloréns-Montes et al. (2005) verify that teamwork cohesion affects the capacity of a company to learn and innovate, since it is important in the development of the learning organization, bridging organizational and individual learning and enhancing knowledge flows between teams and individuals. They argue that "*[t]hrough teamwork, the organization will manage to convert organizational learning into a trait that is valuable to the whole organization …*" (Lloréns-Montes et al., 2005: 1160).

Zeng et al. (2017) defend that teamwork enables employees to suggest ideas for products and process improvements, which is linked to creativity and knowledge management and could, in effect, could foster innovative behaviors and lead to a positive effects on innovation. In the same direction, Kim et al. (2012) argue that, using a team-based problem-solving approach, employees can improve product and service designs. Folkestad and Gonzales (2010) conclude that managers need to pay attention to the importance of teamwork as it relates to making innovation happen. According to Martinez-Costa and Martinez-Lorente (2008), a flexible structure and the use of teamwork can provide a fruitful environment for fostering innovation. In addition, Fay et al. (2015) propose that teamwork changes the affective experiences, cognitions and attitudes of individuals, which in turn enhance their creativity and ability to solve problems. Besides, teamwork is related to structural changes, which enhance the flow of ideas and knowledge and makes the organization more flexible.

2.3 *ORGANIZATIONAL CULTURE*

Organizational culture is an important contextual variable to innovation success (Martin and Terblanche, 2003; Büschgens et al., 2013) and helps to align employee behavior with organizational objectives of innovation (Jassawalla and Sashittal, 2002).

Folkestad and Gonzales (2010: 125) find that innovation "*… is accelerated when a culture exists that supports teamwork where members are empowered to look beyond their organization to adopt external ideas, technology, and innovations*". They state that effective teamwork for innovation requires a culture that incorporates openness, externality, intercultural exchanges, and increasing engagement with virtual environments.

2.4 *HYPOTHESES*

Following the considerations formulated above, the purpose of this paper is to investigate the following hypotheses:

H1: Teamwork has a positive effect on incremental innovation performance.

H2: Teamwork has a positive effect on radical innovation performance.

H3: The relationships between teamwork and innovation performance are moderated by organizational culture.

3. Research Design

3.1 *Sampling and Data Collection*

The data for this paper were collected through the 3rd Continuous Innovation Network (CINet) survey. The unit of analysis was the industrial plant of manufacturing companies from different sectors. The questionnaire was sent to two respondents, one responsible production (COO or similar) and one for innovation (CTO or similar) in the organization. The survey followed a standardized procedure in all countries to ensure the reliability of data between countries and probabilistic sampling. Researchers in each country collected population information on an official national basis, such as the National Confederation of Industry. From this database, randomly selected companies were contacted until a minimum number of respondents was reached (between 30-50 companies). Only medium and large companies should belong to the population and the predefined sectors.

An initial contact was made with the companies by telephone to obtain information from the target respondents. The questionnaire, carried out using SurveyMonkey, was sent by email to the two respondents. Three waves of response requests were made, each with an interval of 15 days.

This paper uses data obtained from the CTOs. In total, 286 responses were obtained. However, questionnaires that had missing data for at least two variables in the same construct or similar responses for all variables (Hair et al., 2017) were removed from the sample. For variables that still had some missing value, this was replaced by the average and no variable exceeded 3% of the replaced data. According to Hair et al. (2017) up to 5% of an indicator can be replaced by the average. A multivariate analysis of outliers was performed using the Mahalanobis distance, identifying one outlier, which was also removed from the sample. The final sample consisted of 138 CTO responses, from eleven countries: Austria N=4, Brazil N=7, Canada N=3, Denmark N=11, Hungary N=19, Italy N=21, The Netherlands N=5, Pakistan N=30, Spain N=17, Sweden N=14, Switzerland N=7.

To investigate the hypotheses, the theoretical model depicted in Figure 1 was developed.

3.2 *Operationalization*

The questionnaire contained a characterization section of the respondent and the company, another section with statements to be answered using five-point Likert-type scale (variables of the Teamwork, Incremental Innovation and Radical Innovation constructs) and a question with qualitative answer options (organizational culture). In this study, we adopt the well-established Competing Values Framework (CVF; e.g. Cameron and Quinn, 2006; Denison and Spreitzer, 1991), for organizational culture. The CVF is based on two main dimensions: the control-flexibility dimension reflects the extent to which an organization focusses on stability vs change whereas the internal-external dimension reflects the organization’s focus on the internal organization vs the external environment. The juxtaposition of these two dimensions creates four cultural profiles: the group, developmental, hierarchical and rational profiles, each one with different characteristics.

Table 1 shows the constructs, items in the form of statements and references.

Table 1. Constructs and measurement

Construct	Item/statements	Code	Adapted from
Team Management (TEAM)	Teamwork involving employees with different know-how and skills	TEAM1	4
	Self-managed teams with decision-making capacity	TEAM2	
	Teams that operate together with suppliers and customers	TEAM3	
	Employee reward systems for problem-solving	TEAM4	
	Incentives for the team, not only for individuals	TEAM5	
Incremental Innovation (II)	Average number of product improvement, modification and customization suggestions formally evaluated per year	II1	5
	Average lead time of product improvement, modification and customization projects	II2	6, 7
	Average time-to-market of product improvement, modification and customization projects, from concept to market launch	II3	1, 7
	Percentage of total sales from improved, modified and customized products introduced in the last three years	II4	1, 2, 3, 5, 6
	Average number of product improvement, modification and customization projects launched per year	II5	3, 6
	Percentage of product improvement, modification and customization projects successfully completed in the last three years	II6	2
	Reputation with customers and competitors for product improvement, modification and/or customization	II7	5
Radical Innovation (RI)	Development of new products that differ substantially from our existing products	RI1	5
	Total new product development costs as a percentage of sales	RI2	1, 2, 3, 5, 6
	Average number of radical product innovation projects launched per year	RI3	3, 6
	Percentage of radical product innovation projects successfully completed in the last three years	RI4	2
	Reputation with customers and competitors for radical product innovations	RI5	1, 5
Organizational Culture	Organizational culture (options a. Group culture b. Developmental culture c. Rational culture d. Hierarchical culture)	CUL	8, 9

1 - Griffin and Page (1993); 2 - Driva et al. (2001); 3 - Atuahene-Gima (2005); 4 - Vázquez-Bustelo et al. (2007); 5 - Kim et al. (2012); 6 - Sun et al. (2012); 7 - Danese and Filippini (2013); 8 - Denison and Spreitzer, (1991); 9 - Cameron and Quinn (2006)

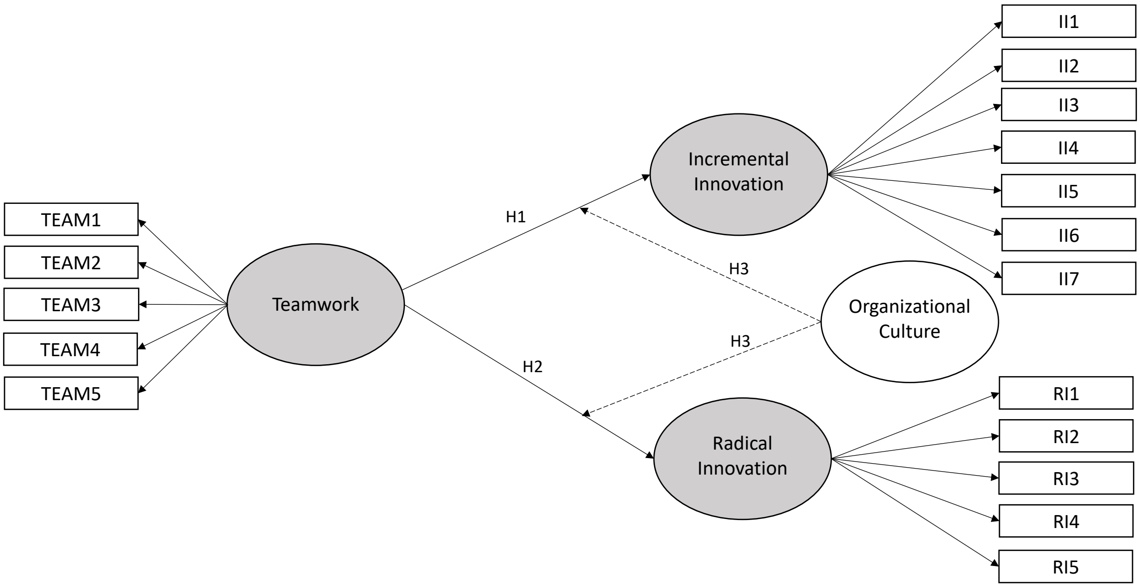

Figure 1. Theoretical model

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), a nonparametric variance-based technique recommended for early stage theoretical development to test and validate exploratory models (Hair et al., 2017).
To identify whether the final sample suffered from common method bias (CMB), we conducted Harman's Single Factor Test (Podsakoff et al., 2003), and obtained 40.3% of most of the variance explained for this single factor, thus ensuring that the CMB did not occur in this research. Finally, we also performed a full collinearity test, which is indicated as a comprehensive test to verify CMB in PLS-SEM (Kock and Lynn, 2012; Kock, 2015). The VIF values in the model are below the threshold of 3.0 as recommended (Kock and Lynn, 2012). The maximum inner VIF value was 2.785. Therefore, the model was considered free of common method bias.

4. RESULTS AND DISCUSSION

4.1 MEASUREMENT MODEL

The conceptual model was composed of three reflective constructs and the first step was to validate the measurement model. During the validation process, it was necessary to exclude an item (TEAM5) to improve validity and reliability. Afterwards, we assessed the reliability of the constructs and the internal consistency between the items of each construct. Cronbach's alpha (CA) and Composite Reliability (CR) were used as reliability indicators (Hair et al., 2017). As shown in Table 2, the CA values vary from 0.680 to 0.910 and the CR values range from 0.805 to 0.928. All the CA and CR values are above the minimum value of 0.60 for exploratory models (Hair et al., 2017).
As shown in Table 3, Convergent Validity is confirmed by the Average Variance Extracted (AVE): the values for all the constructs were above the recommended value of 0.5. The AVE value is related to the loading of each item of the construct, which should be above or equal to 0.7 so that the latent variable explains a substantial part of the variance of each indicator. Loadings between 0.40 and 0.70 should be considered when the AVE value is higher than 0.5. This occurs only for items TEAM1 (0.647), TEAM4 (0.592) and RI1 (0.698), but the constructs' AVE is above 0.5 in the model for all constructs. Therefore, convergent validity was considered satisfied as well.

Table 2. Convergent validity and reliability results

Constructs	Items	Items loadings	CA	CR	AVE
Teamwork (TW)	TEAM1	0.647	0.680	0.805	0.513
	TEAM2	0.778			
	TEAM3	0.822			
	TEAM4	0.592			
Incremental Innovation (II)	II1	0.815	0.910	0.928	0.648
	II2	0.800			
	II3	0.815			
	II4	0.755			
	II5	0.799			
	II6	0.804			
	II7	0.845			
Radical Innovation (RI)	RI1	0.698	0.871	0.907	0.663
	RI2	0.758			
	R!3	0.894			
	R!4	0.877			
	RI5	0.829			

The discriminant validity of the constructs was evaluated using the Fornell-Larcker criteria. In the Fornell-Larcker criterion, the square root of AVE in each construct should be greater than the values of the inter-construct correlations (Hair et al., 2017). Table 3 shows that the square root of AVE of each construct (on the diagonal) is larger than the correlations with the other constructs. Thus, discriminant validity of all the constructs has been established.

Table 3. Fornell-Larcker results

	Teamwork	Incremental Innovation	Radical innovation
Teamwork	0.716		
Incremental Innovation	0.413	0.805	
Radical Innovation	0.454	0.746	0.815

4.2 STRUCTURAL MODEL

After the validation of the measurement model, we assessed the structural model. The first step was to check the collinearity by the inner VIF values, which was satisfied for both endogenous constructs. Then, we evaluated the structural model examining the model's predictive capabilities and the relationships between the constructs (Hair et al., 2017). In this second step, we examined the path coefficients (hypotheses) and their significance levels (p-values) obtained by the Bootstrapping procedure (5000 sub-samples) (Hair et al., 2017). Table 4 shows the results for the hypothesis testing.

Table 4. Hypothesis testing

Hypotheses		Scenario 1		Result
		path coefficients	p-values	
H1	TW → II	0.413	0.000	Supported
H2	TW → RI	0.454	0.000	Supported

Teamwork (TW); Incremental Innovation (II); Radical Innovation (RI)

Table 4 indicates that H1 and H2 are supported: teamwork has a significant effect on incremental innovation (β = 0.41, p-value = 0.000) and on radical innovation (β = 0.45, p-value = 0.000).

The third step to assess the structural model was to estimate the coefficients of determination (R^2) for the endogenous constructs. R^2 values measure to which extent the variance of an endogenous construct (II and RI) is explained by the exogenous constructs' effects (Hair et al., 2017). Based on Cohen (1988), R^2 values higher than 0.26 are considered significant for social sciences. In this study, TM has medium influence on II (R^2=0.17) and medium influence on RI (R^2=0.21).

4.2.1 Multigroup analysis

To examine the moderating effect of culture on the relationships (as per H3), a multigroup analysis was performed. Multigroup analysis compares and tests for differences in the model relationships, the analysis use the same model across different groups of respondents (Sarstedt et al., 2011; Hair et al., 2017). In this analysis, the impact of the four groups of culture profiles was tested. With the 138 respondents, 4 different subgroups were formed for each type of culture (rational, hierarchical, developmental and group culture). A preliminary step for the multigroup analysis is to ensure measurement invariance, tested using the MICON procedure to ensure configural and compositional invariance (Hair et al., 2017). The MICON test was performed (Table 5) and the p-value > 0.05 means that the constructs are similar, guaranteeing configural and compositional invariance.

Table 5. MICON test

Construct	MICON between groups (p-value)					
	Group 1x2	Group 1x3	Group 1x4	Group 2x3	Group 2x4	Group 3x4
Incremental innovation	0.481	0.179	0.945	0.011	0.313	0.081
Team Management	0.495	0.735	0.247	0.791	0.682	0.572
Radical Innovation	0.950	0.158	0.436	0.198	0.325	0.418

Culture types: 1=Rational (N=54); 2-Hierarchical (N=37);
3=Developmental (N=34); 4=Group (N=13)

To verify if the path coefficients are similar or different, a nonparametric permutation test can be used in the context of PLS-SEM (Hair et al., 2017). Table 6 shows the differences in path coefficients between the four culture groups[1]. A p-value < 0.05 indicates that there

[1] A similar test is the PLS-Multi Group Analysis (MGA) (Hair et al., 2017), indicated especially when one group is more than twice as large as the other. This test was also carried out since groups 1, 2 and 3 are more than twice the size of group 4. The results are not presented here, but they are similar to those in Table 6.

is a difference in the intensity of the relationship; otherwise, the relationship is similar between cultures. As all p-values are larger than 0.05, H3 is rejected.

Table 6. Permutation (bootstrapping 5000)

Relationship	Differences between groups (p-value)					
	Group 1x2	**Group 1x3**	**Group 1x4**	**Group 2x3**	**Group 2x4**	**Group 3x4**
TM→II	0.138	0.707	0.205	0.126	0.559	0.238
TM→RI	0.886	0.691	0.138	0.545	0.136	0.080

Culture types: 1=Rational (n=54); 2-Hierarchical (n=37);
3=Developmental (n=34); 4=Group (n=13)

5. CONCLUSIONS

The results show a positive, and nearly equal, effect of teamwork on radical innovation and incremental innovation performance. Thus, one of the most prevalent factors of QM practices helps companies to obtain better innovation results. The study also considers the moderating effects of organizational culture but does not find such an effect. Therefore, teamwork appears to strengthen innovation performance in all organizational cultures.

The results confirm that teamwork has a positive effect on innovation, agreeing with earlier studies (e.g. West et al., 2004; Ali et al., 2010; Folkestad and Gonzales, 2010), and add to existing theory by confirming the hypotheses that teamwork has a positive effect on both incremental and radical innovation.

Regarding the analysis of organizational culture and its importance as a contextual variable for innovation success (Martin and Terblanche, 2003; Büschgens et al., 2013), the research contributes by showing that regardless of an organization's culture, the effect of teamwork on innovation remains constant. Therefore, while the need to align employee behavior with an organization's innovation objectives, through culture (Jassawalla and Sashittal, 2002) remains undisputed, teamwork adds to the innovation performance of companies, irrespective of their culture.

For managers, the results imply that strengthening teamwork practices, promoting the joining of people with different capabilities, decision-making capacity, and directing the team to solve problems together with customers and suppliers, affect innovation positively.

The study's limitations include a relatively small sample of respondents when looking at the number by country. Also due to this low number of responses, it was not possible to make an analysis of possible country-level effects.

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